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Design Procedure for Compact Folded Waveguide Filters

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Waveguide filters are widely used in communication systems due to low losses and high power handling capabilities. One drawback of the conventional waveguide filters is their large size, especially for low-frequency and high-order realizations. It has been shown that the footprint of conventional waveguide resonators can be reduced to one quarter by folding the electric and magnetic fields inside the cavity (J. S. Hong, *Microwave Symposium Digest*, 2004, Vol. 1, pp. 213-216).

This paper presents a novel systematic procedure for designing compact low-loss bandpass filters by using folded waveguide resonators. As a design example, a scaled version of a filter specified for a TETRA (Terrestrial Trunked Radio) system has been considered. The folded waveguide filter is designed to fulfil specific requirements, and the design procedure can be easily applied to other folded waveguide filter designs. The insertion loss in the pass-band (1.54 GHz – 1.56 GHz) is specified to be less than 1 dB while the return loss should be more than 18 dB. The isolation in the rejection-band (1.58 GHz – 1.60 GHz) is required to be more than 45 dB. The coupling matrix synthesis is introduced first and a two-layer realization structure is proposed with about 87.5% reduction of the footprint compared to a conventional waveguide filter design. After that, a step-by-step description of the design procedure that meets the specific requirements is given. The designed folded waveguide structure is modelled and verified by three-dimensional full-wave electromagnetic simulations. The proposed structure and the fabricated folded waveguide filter are shown in Fig. 1.

A network analyzer (HP8720D) was used to test the fabricated folded waveguide filter. The measurement results are shown in Fig. 2 in comparison with the simulation results. A good agreement between the simulation and measurement validates the described design procedure.

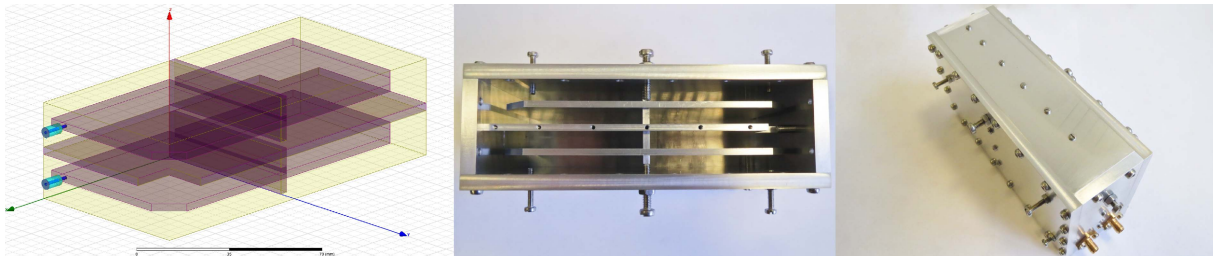


Fig. 1. Proposed structure and fabricated folded waveguide filter.

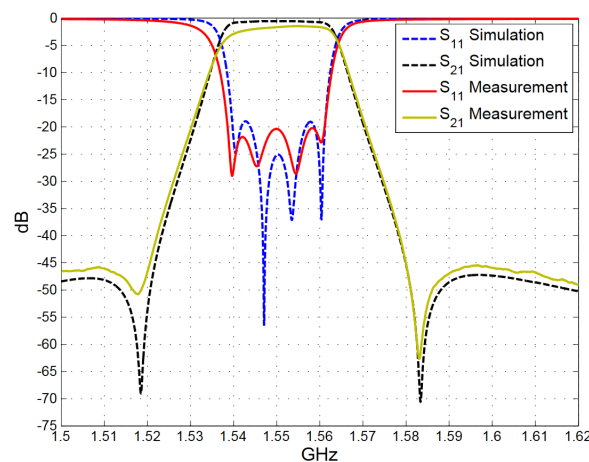


Fig. 2. Simulation and measurement results of the designed folded waveguide filter.